CLAIMS

What is claimed is:

1. A method for performing a simulation process for a design using a set of existing stimuli that are specified in a predetermined sequence, the method comprising the steps of:

dividing all possible design states for the design into a plurality of validation regions;

recording simulation history for all the validation regions during the simulation process;

generating a new set of stimuli by examining the existing stimuli based on the simulation history; and

performing the simulation process using the new set of stimuli.

2. The method of claim 1, wherein the new set of stimuli is generated by substituting at least one of the existing stimuli with a new stimulus based on the simulation history.

3. The method of claim 1, wherein the new set of stimuli is generated by changing the order in the sequence of the existing stimuli based on the simulation history.

4. A method for performing a simulation process for a design using a set of existing stimuli that are specified in a predetermined sequence, the method comprising the steps of:

dividing all possible validation states for the design into a plurality of validation regions;

recording simulation history for each of the validation regions during the simulation process;

taking a stimulus from the existing stimuli for performing a next simulation step for a current validation region, wherein the stimulus is taken in an order specified by the predetermined sequence;

examining the simulation history for the taken stimulus in the current validation region; and

transforming the taken stimulus into an interesting stimulus based on the simulation history.

5. The method of claim 4, wherein the step of transforming improves simulation efficiency and simulation coverage.

6. The method of claim 4, wherein the taken simulation stimulus validates one of the validation regions, and the transformed simulation stimulus validates another one of the validation regions.

7. The method of claim 4, the simulation history including the numbers of occurrences for stimuli that have used in each of the validation regions during the simulation process, the step of transforming further comprising the steps of:

determining whether the number of occurrences of the taken stimulus in the current validation region exceeds a predetermined value;

using the taken stimulus as a stimulus in a subsequent step of the simulation process, if the number of occurrence for the taken stimulus does not exceed the predetermined value; and

selecting a stimulus from the set of stimuli with the least number of occurrences for the current validation region, and using the selected stimulus in a subsequent step of the simulation process, if the number of occurrences for the taken stimulus exceeds the predetermined value.

8. The method of claim 4, further comprising the steps of:

receiving a stimulus specification; and

determining whether the taken stimulus is legal according to the stimulus specification.

9. The method of claim 4, further comprising the step of:

updating the simulation history for the current simulation region.

10. A method for performing a simulation process for a design using a stimulus specification , the method comprising the steps of:

dividing all possible design states for the design into a plurality of validation regions;

recording simulation history for each of the validation regions during the simulation process; and

generating an interesting stimulus in accordance with the stimulus specification based on the simulation history of the validation regions.

11. The method of claim 10, the simulation history including the numbers of occurrences for stimuli used in each of the validation regions during the simulation process, the step of transforming further comprising the steps of:

selecting a stimulus in accordance with the stimulus specification with the least number of occurrences for the current validation region, and using the selected stimulus in a subsequent step of the simulation process.

12. The method of claim 10, further comprising the step of:

updating the simulation history for the current simulation region.

13. A method for performing a simulation process for a design using a set of existing stimuli that are specified in a predetermined sequence, the design

having M (M>=2) inputs, and each of the stimuli having M values for its respective M inputs, the method comprising the steps of:

defining N (N>=2) different partitions for all possible design states of the design, each of the partitions dividing the design states into a plurality of validation regions;

associating each of the design inputs with one of the partitions, so that each of the validation regions in each of the partitions is associated with a set of design inputs;

recording simulation history for each of the validation regions in each of the partitions during the simulation process;

taking a stimulus from the set of stimuli for the next simulation step, wherein the stimulus is taken in an order specified by the predetermined sequence;

examining the simulation history for the value in each of the design inputs within the taken stimulus; and

transforming the taken stimulus into an interesting stimulus based on the simulation history.

14. The method of claim 13, wherein the step of transforming improves simulation efficiency and simulation coverage.

15. The method of claim 13, wherein the taken simulation stimulus validates one of the validation regions, and the transformed simulation stimulus validates another one of the validation regions.

16. The method of claim 13, the simulation history including a number of occurrences for each of the values used for the design inputs associated with each of the validation regions during the simulation process, the step of transforming further comprising the steps of:

determining whether the number of occurrences of value in each of the design inputs within the taken stimulus in the current validation region associated with the corresponding input exceeds a predetermined value;

using the taken stimulus as a stimulus in a subsequent step of the simulation process, if the number of occurrences for the value of each of the design inputs in the taken stimulus does not exceed the predetermined value; and

selecting a value for an design input from the set of values with the least number of occurrences for the current validation region associated with the corresponding input, and using the selected value for the design input in a subsequent step of the simulation process, if the number of occurrences for the value of the design input in the taken stimulus exceeds the predetermined value.

17. The method of claim 13, further comprising the steps of:

receiving a stimulus specification; and

determining whether the taken stimulus is legal according to the stimulus specification.

18. The method of claim 13, further comprising the step of:

updating the simulation history for the current simulation regions associated with all design inputs.

19. An apparatus for performing a simulation process for a design using a set of existing stimuli that are specified in a predetermined sequence, the apparatus comprising:

means for dividing all possible design states for the design into a plurality of validation regions;

means for recording simulation history for all the validation regions during the simulation process;

means for generating a new set of stimuli by examining the existing stimuli based on the simulation history; and

means for performing the simulation process using the new set of stimuli.

20. The apparatus of claim 19, further including: means for substituting at least one of the existing stimuli with a new stimulus based on the simulation history.

21. The apparatus of claim 19, further including: means for changing the order in the sequence of the existing stimuli based on the simulation history.

22. An apparatus for performing a simulation process for a design using a set of existing stimuli that are specified in a predetermined sequence, the apparatus comprising:

means for dividing all possible validation states for the design into a plurality of validation regions;

means for recording simulation history for each of the validation regions during the simulation process;

means for taking a stimulus from the existing stimuli for performing a next simulation step for a current validation region, wherein the stimulus is taken in an order specified by the predetermined sequence;

means for examining the simulation history for the taken stimulus in the current validation region; and

means for transforming the taken stimulus into an interesting stimulus based on the simulation history.

23. The apparatus of claim 22, wherein the taken stimulus is transformed to improve simulation efficiency and simulation coverage.

24. The apparatus of claim 22, wherein the taken simulation stimulus validates one of the validation regions, and the transformed simulation stimulus validates another one of the validation regions.

25. The apparatus of claim 22, the simulation history including the numbers of occurrences for stimuli that have used in each of the validation regions during the simulation process, the apparatus further comprising:

means for determining whether the number of occurrence of the taken stimulus in the current validation region exceeds a predetermined value;

means for using the taken stimulus as a stimulus in a subsequent step of the simulation process, if the number of occurrence for the taken stimulus does not exceed the predetermined value; and

means for selecting a stimulus from the set of stimuli with the least number of occurrences for the current validation region, and using the selected stimulus in a subsequent step of the simulation process, if the number of occurrences for the taken stimulus exceeds the predetermined value.

26. The method of claim 22, further comprising:

means for receiving a stimulus specification; and

means for determining whether the taken stimulus is legal according to the stimulus specification.

27. The method of claim 22, further comprising:

means for updating the simulation history for the current simulation region.

28. An apparatus for performing a simulation process for a design using a stimulus specification , the apparatus comprising:

means for dividing all possible design states for the design into a plurality of validation regions;

means for recording simulation history for each of the validation regions during the simulation process; and

means for generating an interesting stimulus in accordance with the stimulus specification based on the simulation history of the validation regions.

29. The apparatus of claim 28, the simulation history including the numbers of occurrences for stimuli used in each of the validation regions during the simulation process, the apparatus further comprising:

means for selecting a stimulus in accordance with the stimulus specification with the least number of occurrence for the current validation region, and using the selected stimulus in a subsequent step of the simulation process.

30. The apparatus of claim 28, further comprising:

means for updating the simulation history for the current simulation region.

31. An apparatus for performing a simulation process for a design using a set of existing stimuli that are specified in a predetermined sequence, the design having M (M>=2) inputs, and each of the stimuli having M values for its respective M inputs, the apparatus comprising:

means for dividing all possible design states into N (N>=2) different partitions for the design, each of the partitions dividing the design states into a plurality of validation regions;

means for associating each of the design inputs with one of the partitions, so that each of the validation regions in each of the partitions is associated with a set of design inputs;

means for recording simulation history for each of the validation regions in each of the partitions during the simulation process;

means for taking a stimulus from the set of stimuli for the next simulation step, wherein the stimulus is taken in an order specified by the predetermined sequence;

means for examining the simulation history for the value in each of the design inputs within the taken stimulus; and

means for transforming the taken stimulus into an interesting stimulus based on the simulation history.

32. The apparatus of claim 31, wherein the taken stimulus is transformed to improve simulation efficiency and simulation coverage.

33. The apparatus of claim 31, wherein the taken simulation stimulus validates one of the validation regions, and the transformed simulation stimulus validates another one of the validation regions.

34. The apparatus of claim 31, the simulation history including a number of occurrences for each of the values used for the design inputs associated with each of the validation regions during the simulation process, the apparatus further comprising:

means for determining whether the number of occurrences of the value in each of the design inputs within the taken stimulus in the current validation region associated with the corresponding input exceeds a predetermined value;

means for using the taken stimulus as a stimulus in a subsequent step of the simulation process, if the number of occurrences for the value of each of the design inputs in the taken stimulus does not exceed the predetermined value; and

means for selecting a value for an design input from the set of values with the least number of occurrences for the current validation region associated with the corresponding input, and using the selected value for the design input in a

subsequent step of the simulation process, if the number of occurrences for the value of the design input in the taken stimulus exceeds the predetermined value.

35. The apparatus of claim 31, further comprising:

means for receiving a stimulus specification; and

means for determining whether the taken stimulus is legal according to the stimulus specification.

36. The apparatus of claim 31, further comprising:

means for updating the simulation history for the current simulation regions associated with all design inputs.